Sub B1

1. A gas generating composition comprising:

a complex of a metal cation and a neutral ligand containing hydrogen and nitrogen, such that when the complex combusts, a mixture of gases containing nitrogen gas and water vapor is produced; and

sufficient oxidizing anion to balance the charge of the metal cation.

2. A gas generating composition as defined in claim 1, wherein the complex is selected from the group consisting of metal nitrite ammines, metal nitrate ammines, metal perchlorate ammines, metal nitrite hydrazines, metal nitrate hydrazines, metal perchlorate hydrazines, and mixtures thereof.

3. A gas generating composition as defined in claim 1, wherein the complex is a metal nitrite ammine.

4. A gas generating composition as defined in claim 1, wherein the complex is a metal nitrate ammine.

5. A gas generating composition as defined in claim 1, wherein the complex is a metal perchlorate ammine.

6. A gas generating composition as defined in claim 1, wherein the complex is a metal nitrite hydrazine.

7. A gas generating composition as defined in claim 1, wherein the complex is a metal nitrate hydrazine.

8. A gas generating composition as defined in claim 1, wherein the complex is a metal perchlorate hydrazine.

9. A gas generating composition as defined in claim 1, wherein the metal cation is a transition metal, alkaline earth metal, metalloid, or lanthanide metal cation.

10. A gas generating composition as defined in claim 9, wherein the metal cation is selected from the group consisting of magnesium, manganese, nickel, titanium, copper, chromium, zinc, and tin.

11. A gas generating composition as defined in claim 1, wherein the metal cation is a transition metal cation.

12. A gas generating composition as defined in claim 11, wherein the transition metal cation is cobalt.

13. A gas generating composition as defined in claim 11, wherein the transition metal cation is selected from the group consisting of rhodium, iridium, ruthenium, palladium, and platinum.

14. A gas generating composition as defined in claim 1, wherein the oxidizing anion is coordinated with the metal cation.

15. A gas generating composition as defined in claim 1, wherein the oxidizing anion is selected from the group consisting of nitrate, nitrite, chlorate, perchlorate, peroxide, and superoxide.

16. A gas generating composition as defined in claim 1, wherein the inorganic oxidizing anion and the inorganic neutral ligand are free of carbon.

17. A gas generating composition as defined in claim 1, wherein the complex includes at least one other common ligand, in addition to the neutral ligand.

18. A gas generating composition as defined in claim 17, wherein the common ligand is selected from the group consisting of aquo (H_2O), hydroxo (OH), perhydroxo (O_2H), peroxo (O_2), carbonato (CO_3), carbonyl (CO), oxalato (C_2O_4), nitrosyl (NO), cyano (CN), isocyanato (NC), isothiocyanato (NCS), thiocyanato (SCN), amido (NH_2), imdo (NH), sulfato (SO_4), chloro (Cl), fluoro (F), phosphato (PO_4), and ethylenediaminetetraacetic acid (EDTA) ligands.

19. A gas generating composition as defined in claim 1, wherein the complex includes a common counter ion in addition to the oxidizing anion.

20. A gas generating composition as defined in claim 19, wherein the common counter ion is selected from the group consisting of hydroxide (OH^-), chloride (Cl^-), fluoride (F^-), cyanide (CN^-), thiocyanate (SCN^-), carbonate (CO_3^{-2}), sulfate (SO_4^{-2}), phosphate (PO_4^{-3}), oxalate ($C_2O_4^{-2}$), borate (BO_4^{-5}), and ammonium (NH_4^+) counter ions.

21. A gas generating composition as defined in claim 1, wherein the complex and oxidizing anion combined have a concentration in the gas generating composition from 50% to 80% by weight, wherein the gas generating composition further comprises a binder and a co-oxidizer such that the binder has a concentration in the gas generating composition from 0.5% to 10% by weight and the co-oxidizer has a concentration in the gas generating composition from 5% to 50% by weight.

22. A gas generating composition as defined in claim 1, further comprising a co-oxidizer.

23. A gas generating composition as defined in claim 22, wherein the co-oxidizer is selected from alkali, alkaline earth, lanthanide, or ammonium perchlorates, chlorates, peroxides, nitrites, and nitrates.

24. A gas generating composition as defined in claim 22, wherein the co-oxidizer is selected from metal oxides, metal hydroxides, metal peroxides, metal oxide hydrates, metal oxide hydroxides, metal hydrous oxides, basic metal carbonates, basic metal nitrates, and mixtures thereof.

25. A gas generating composition as defined in claim 22, wherein the co-oxidizer is selected from oxides of copper, cobalt, manganese, tungsten, bismuth, molybdenum, and iron.

26. A gas generating composition as defined in claim 22, wherein the co-oxidizer is a metal oxide selected from CuO, Co_2O_3, Co_3O_4, $CoFe_2O_4$, Fe_2O_3, MoO_3, Bi_2MoO_6, and Bi_2O_3.

27. A gas generating composition as defined in claim 22, wherein the co-oxidizer is a metal hydroxide selected from $Fe(OH)_3$, $Co(OH)_3$, $Co(OH)_2$, $Ni(OH)_2$, $Cu(OH)_2$, and $Zn(OH)_2$.

28. A gas generating composition as defined in claim 22, wherein the co-oxidizer is a metal oxide hydrate or metal hydrous oxide selected from $Fe_2O_3 \cdot xH_2O$, $SnO_2 \cdot xH_2O$, and $MoO_3 \cdot H_2O$.

29. A gas generating composition as defined in claim 22, wherein the co-oxidizer is a metal oxide hydroxide selected from $CoO(OH)_2$, $FeO(OH)_2$, $MnO(OH)_2$, and $MnO(OH)_3$.

30. A gas generating composition as defined in claim 22, wherein the co-oxidizer is a basic metal carbonate selected from $CuCO_3 \cdot Cu(OH)_2$ (malachite), $2Co(CO_3) \cdot 3Co(OH)_2 \cdot H_2O$, $Co_{0.69}Fe_{0.34}(CO_3)_{0.2}(OH)_2$, $Na_3[Co(CO_3)_3] \cdot 3H_2O$, $Zn_2(CO_3)(OH)_2$, $Bi_2Mg(CO_3)_2(OH)_4$, $Fe(CO_3)_{0.12}(OH)_{2.76}$, $Cu_{1.54}Zn_{0.46}(CO_3)(OH)_2$, $Co_{0.49}Cu_{0.51}(CO_3)_{0.43}(OH)_{1.1}$, $Ti_3Bi_4(CO_3)_2(OH)_2O_9(H_2O)_2$, and $(BiO)_2CO_3$.

31. A gas generating composition as defined in claim 22, wherein the co-oxidizer is a basic metal nitrate selected from $Cu_2(OH)_3NO_3$, $Co_2(OH)_3NO_3$, $CuCo(OH)_3NO_3$, $Zn_2(OH)_3NO_3$, $Mn(OH)_2NO_3$, $Fe_4(OH)_{11}NO_3 \cdot 2H_2O$, $Mo(NO_3)_2O_2$, $BiONO_3 \cdot H_2O$, and $Ce(OH)(NO_3)_3 \cdot 3H_2O$.

32. A gas generating composition as defined in claim 1, further comprising a binder.

33. A gas generating composition as defined in claim 32, wherein the binder is water soluble.

34. A gas generating composition as defined in claim 33, wherein the binder is selected from naturally occurring gums, polyacrylic acids, and polyacrylamides.

35. A gas generating composition as defined in claim 32, wherein the binder is not water soluble.

36. A gas generating composition as defined in claim 35, wherein the binder is selected from nitrocellulose, VAAR, and nylon.

37. A gas generating composition as defined in claim 1, wherein the complex is hexaamminecobalt(III) nitrate, ($[(NH_3)_6Co](NO_3)_3$) and the co-oxidizer is copper(II) trihydroxy nitrate ($Cu_2(OH)_3NO_3$).

38. A gas generating composition as defined in claim 1, further comprising carbon powder present from 0.1% to 6% by weight of the gas generating composition, wherein the composition exhibits improved crush strength compared to the composition without carbon powder.

39. A gas generating composition as defined in claim 1, further comprising carbon powder present from 0.3% to 3% by weight of the gas generating composition.

40. A method of inflating an air bag comprising combusting a gas generating composition containing a complex of a transition metal cation or alkaline earth metal cation and a neutral ligand containing hydrogen and nitrogen and sufficient oxidizing anion to balance the charge of the metal cation, such that when the gas generating composition combusts, a mixture of gases containing nitrogen gas and water vapor is produced.

41. A method of inflating an air bag as defined in claim 40, wherein the combustion of the metal complex is initiated by heat.

42. A method of inflating an air bag as defined in claim 40, wherein the complex is selected from the group consisting of metal nitrite ammines, metal nitrate ammines, metal perchlorate ammines, metal nitrite hydrazines, metal nitrate hydrazines, metal perchlorate hydrazines, and mixtures thereof.

43. A method of inflating an air bag as defined in claim 40, wherein the complex is a metal nitrite ammine.

44. A method of inflating an air bag as defined in claim 40, wherein the complex is a metal nitrate ammine.

45. A method of inflating an air bag as defined in claim 40, wherein the complex is a metal perchlorate ammine.

46. A method of inflating an air bag as defined in claim 40, wherein the complex is a metal nitrite hydrazine.

47. A method of inflating an air bag as defined in claim 40, wherein the complex is a metal nitrate hydrazine.

48. A method of inflating an air bag as defined in claim 40, wherein the complex is a metal perchlorate hydrazine.

49. A method of inflating an air bag as defined in claim 40, wherein the transition metal cation is cobalt.

50. A method of inflating an air bag as defined in claim 40, wherein the transition metal cation or alkaline earth metal cation is selected from the group consisting of magnesium, manganese, nickel, titanium, copper, chromium, and zinc.

51. A method of inflating an air bag as defined in claim 40, wherein the transition metal cation is selected from the group consisting of rhodium, iridium, ruthenium, palladium, and platinum.

52. A method of inflating an air bag as defined in claim 40, wherein the oxidizing anion is coordinated with the metal cation.

53. A method of inflating an air bag as defined in claim 40, wherein the oxidizing anion is selected from the group consisting of nitrate, nitrite, chlorate, perchlorate, peroxide, superoxide, and mixtures thereof.

54. A method of inflating an air bag as defined in claim 40, wherein the inorganic oxidizing anion and the inorganic neutral ligand are free of carbon.

55. A method of inflating an air bag as defined in claim 40, wherein the complex includes at least one other common ligand, in addition to the neutral ligand.

56. A method of inflating an air bag as defined in claim 40, wherein the common ligand is selected from the group consisting of aquo (H_2O), hydroxo (OH), perhydroxo (O_2H), peroxo (O_2), carbonato (CO_3), carbonyl (CO), oxalato (C_2O_4), nitrosyl (NO), cyano (CN), isocyanato (NC), isothiocyanato (NCS), thiocyanato (SCN), amido (NH_2), imdo (NH), sulfato (SO_4), chloro (Cl), fluoro (F), phosphato (PO_4), and ethylene-diaminetetraacetic acid (EDTA) ligands.

57. A method of inflating an air bag as defined in claim 40, wherein the complex includes a common counter ion in addition to the oxidizing anion.

58. A method of inflating an air bag as defined in claim 57, wherein the common counter ion is selected from the group consisting of hydroxide (OH^-), chloride (Cl^-), fluoride (F^-), cyanide (CN^-), thiocyanate (SCN^-), carbonate (CO_3^{-2}), sulfate (SO_4^{-2}), phosphate (PO_4^{-3}), oxalate ($C_2O_4^{-2}$), borate (BO_4^{-5}), and ammonium (NH_4^+) counter ions.

59. A method of inflating an air bag as defined in claim 40, wherein the complex and oxidizing anion combined have a concentration in the gas generating composition from 50% to 80% by weight, wherein the gas generating composition further comprises a binder and a co-oxidizer such that the binder has a concentration in the gas generating composition from 0.5% to 10% by weight and the co-oxidizer has a concentration in the gas generating composition from 5% to 50% by weight.

60. A method of inflating an air bag as defined in claim 40, wherein the gas generating composition which is combusted further comprising a co-oxidizer.

61. A method of inflating an air bag as defined in claim 60, wherein the co-oxidizer is selected from alkali, alkaline

earth, or ammonium perchlorates, chlorates, peroxides, and nitrates.

62. A method of inflating an air bag as defined in claim 60, wherein the co-oxidizer is selected from metal oxides, metal hydroxides, metal peroxides, metal oxide hydrates, metal oxide hydroxides, metal hydrous oxides, basic metal carbonates, basic metal nitrates, and mixtures thereof.

63. A method of inflating an air bag as defined in claim 60, wherein the co-oxidizer is selected from oxides of copper, cobalt, manganese, tungsten, bismuth, molybdenum, and iron.

64. A method of inflating an air bag as defined in claim 60, wherein the co-oxidizer is a metal oxide selected from CuO, Co_2O_3, Co_3O_4, $CoFe_2O_4$, Fe_2O_3, MoO_3, Bi_2MoO_6, and Bi_2O_3.

65. A method of inflating an air bag as defined in claim 60, wherein the co-oxidizer is a metal hydroxide selected from $Fe(OH)_3$, $Co(OH)_3$, $Co(OH)_2$, $Ni(OH)_2$, $Cu(OH)_2$, and $Zn(OH)_2$.

66. A method of inflating an air bag as defined in claim 60, wherein the co-oxidizer is a metal oxide hydrate or metal hydrous oxide selected from $Fe_2O_3 \cdot xH_2O$, $SnO_2 \cdot xH_2O$, and $MoO_3 \cdot H_2O$.

67. A method of inflating an air bag as defined in claim 60, wherein the co-oxidizer is a metal oxide hydroxide selected from $CoO(OH)_2$, $FeO(OH)_2$, $MnO(OH)_2$, and $MnO(OH)_3$.

68. A method of inflating an air bag as defined in claim 60, wherein the co-oxidizer is a basic metal carbonate selected from $CuCO_3 \cdot Cu(OH)_2$ (malachite), $2Co(CO_3) \cdot 3Co(OH)_2 \cdot H_2O$, $Co_{0.69}Fe_{0.34}(CO_3)_{0.2}(OH)_2$, $Na_3[Co(CO_3)_3] \cdot 3H_2O$, $Zn_2(CO_3)(OH)_2$, $Bi_2Mg(CO_3)_2(OH)_4$, $Fe(CO_3)_{0.12}(OH)_{2.76}$, $Cu_{1.54}Zn_{0.46}(CO_3)(OH)_2$, $Co_{0.49}Cu_{0.51}(CO_3)_{0.43}(OH)_{1.1}$, $Ti_3Bi_4(CO_3)_2(OH)_2O_9(H_2O)_2$, and $(BiO)_2CO_3$.

69. A method of inflating an air bag as defined in claim 60, wherein the co-oxidizer is a basic metal nitrate selected from $Cu_2(OH)_3NO_3$, $Co_2(OH)_3NO_3$, $CuCo(OH)_3NO_3$, $Zn_2(OH)_3NO_3$, $Mn(OH)_2NO_3$, $Fe_4(OH)_{11}NO_3 \cdot 2H_2O$, $Mo(NO_3)_2O_2$, $BiONO_3 \cdot H_2O$, and $Ce(OH)(NO_3)_3 \cdot 3H_2O$.

70. A method of inflating an air bag as defined in claim 40, wherein the gas generating composition which is combusted further comprising a binder.

71. A method of inflating an air bag as defined in claim 70, wherein the binder is water soluble.

72. A method of inflating an air bag as defined in claim 71, wherein the binder is selected from naturally occurring gums, polyacrylic acids, and polyacrylamides.

73. A method of inflating an air bag as defined in claim 70, wherein the binder is not water soluble.

74. A method of inflating an air bag as defined in claim 73, wherein the binder is selected from nitrocellulose, VAAR, and nylon.

75. A method of inflating an air bag as defined in claim 40, wherein the complex is hexaamminecobalt(III) nitrate, ($[(NH_3)_6Co](NO_3)_3$) and the co-oxidizer is copper(II) trihydroxy nitrate ($Cu_2(OH)_3NO_3$).

76. A method of inflating an air bag as defined in claim 40, further comprising carbon powder present from 0.1% to 6% by weight of the gas generating composition, wherein the composition exhibits improved crush strength compared to the composition without carbon powder.

77. A method of inflating an air bag as defined in claim 40, further comprising carbon powder present from 0.3% to 3% by weight of the gas generating composition.

78. A gas generating device comprising:

a gas generating composition comprising:

a complex of a transition metal cation or alkaline earth metal cation and a neutral ligand containing hydrogen and nitrogen, such that when the complex combusts, a mixture of gases containing nitrogen gas and water vapor is produced;

sufficient oxidizing anion to balance the charge of the metal cation; and

means for initiating the combustion of the composition.

79. A gas generating device as defined in claim 78, wherein the means for initiating the combustion includes an igniter composition comprising a mixture of different igniter compositions.

80. A gas generating device as defined in claim 78, wherein the means for initiating the combustion includes an igniter composition comprising a mixture of $Mg/Sr(NO_3)_2$/nylon and B/KNO_3.

81. An automobile air bag system comprising:

a collapsed, inflatable air bag;

a gas-generating device connected to the air bag for inflating the air bag, the gas-generating device containing a gas-generating composition comprising:

a complex of a transition metal cation or alkaline earth metal cation and a neutral ligand containing hydrogen and nitrogen, such that when the complex combusts, a mixture of gases containing nitrogen gas and water vapor is produced;

sufficient oxidizing anion to balance the charge of the metal cation; and

means for igniting the gas-generating composition.

82. A vehicle containing a supplemental restraint system having an air bag system comprising:

a collapsed, inflatable air bag;

a gas-generating device connected to the air bag for inflating the air bag, the gas-generating device containing a gas-generating composition comprising:

a complex of a transition metal cation or alkaline earth metal cation and a neutral ligand containing hydrogen and nitrogen, such that when the complex combusts, a mixture of gases containing nitrogen gas and water vapor is produced;

sufficient oxidizing anion to balance the charge of the metal cation; and

means for igniting the gas-generating composition.

Add B1

Add C2

add D2

add E1

add F2